CHARA BAUERI A.Br., A CHAROPHYTE WITH A DISJUNCT DISTRIBUTION

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ABSTRACT - *Chara baueri* has been found in Kazakhstan (1994) and Sweden (1849). Little is known about the recent distribution of the species in Europe, as no specimens have been collected since 1871. The species is also found in Australia, the last time in 1936. The disjunct distribution of this species most probably indicates relict ▬ from a period when the species was continuously distributed from Europe to Australia. This view is supported by the find in Kazakhstan.

RÉSUMÉ - *Chara baueri* ■ été découvert en Suède (1849) ■ au Kazakhstan (1994). Peu de données concernent la répartition de cette espèce en Europe où aucun spécimen n'a été récolté depuis 1871. L'espèce ■ aussi été observée en Australie, pour la dernière fois en 1936. La répartition disjointe de cette espèce indique très probablement des aires relictes d'une période pendant laquelle l'espèce était répartie de façon continue de l'Europe à l'Australie. Ce point de vue s'appuie sur sa découverte dans le Kazakhstan.

РЕЗЮМЕ - Приведены описания образцов *Chara baueri A.Br.*, найденных в Швеции (1849) и в Казахстане (1994). О европейском распространении вида имеется мало сведений, так как после 1871 г. его не отмечали в этой части ареала. В 1936 г. вид был найден в нескольких пунктах Австралии. Находка ■ Казахстане подтверждает, что дизъюнкция ареала имеет реликтовый характер. Вероятно, в прошлом этот вид был распространен более широко от Европы до Австралии. Не исключено и то, что отмеченная популяция вида на севере Казахстана возникла вследствие инвазии из района основного распространения.

KEY WORDS : *Chara baueri*, Charophytes, Europe, Kazakhstan, Australia.

INTRODUCTION

Chara baueri was first collected by Bauer in Berlin and named *Chara scoparia* by Reichenbach in Moesslers Handbook (Reichenbach, 1829). The original name has been found to be illegal (cf. Wood, 1962, Wood & Imahori, 1965), and the legal name today is *Chara baueri* Alexander Braun (Braun, 1847).

DESCRIPTIONS

General description of the species

Chara baueri is a haplostephanous species. Relatively small plants, up to 10 cm. Axes up to 1mm in diameter. Cortex 2-3 corticate, isostichous. Other parts of the plant lack cortication. Branchlet 8-10 in a whorl, often slightly swollen. End-cell and bract-cells forming a *corona*. Plants monoecious. Bract-cells well developed.

Species closely related to *Chara braunii* Gmelin. The form f. *mülleri* A.Br. is here included in the species, which is in accordance with Wood (1972). Good descriptions and illustrations of the species can be found in Nordstedt (1891) and Migula (1897). In this article we will deal with two finds of the species; a new discovery from Kazakhstan and the find from Sweden reported by Blindow (1994).

Description of the specimens from Sweden (Fig. 1a)

Plant monoecious. 4.6 cm high. Slightly encrusted. *Axes* 930 µm in diameter, internodes to 1.3 cm long. *Stem cortex* difficult to determine, but seems to be mostly 2-corticate. Cortex-cells isostichous. *Spine-cells* solitary, acute to 0.5x stem diameter. Many spine-cells on young internodes. Only few on the lower stem parts. *Stipulodes* in one tier, well developed, acute, to 1.2 mm long. *Branchlets* 7-8 in a whorl, to 1.5 cm long, ecorticate, 1x to 2x internode, with 4 segments. *Corona* 400 µm long. Bract-cells

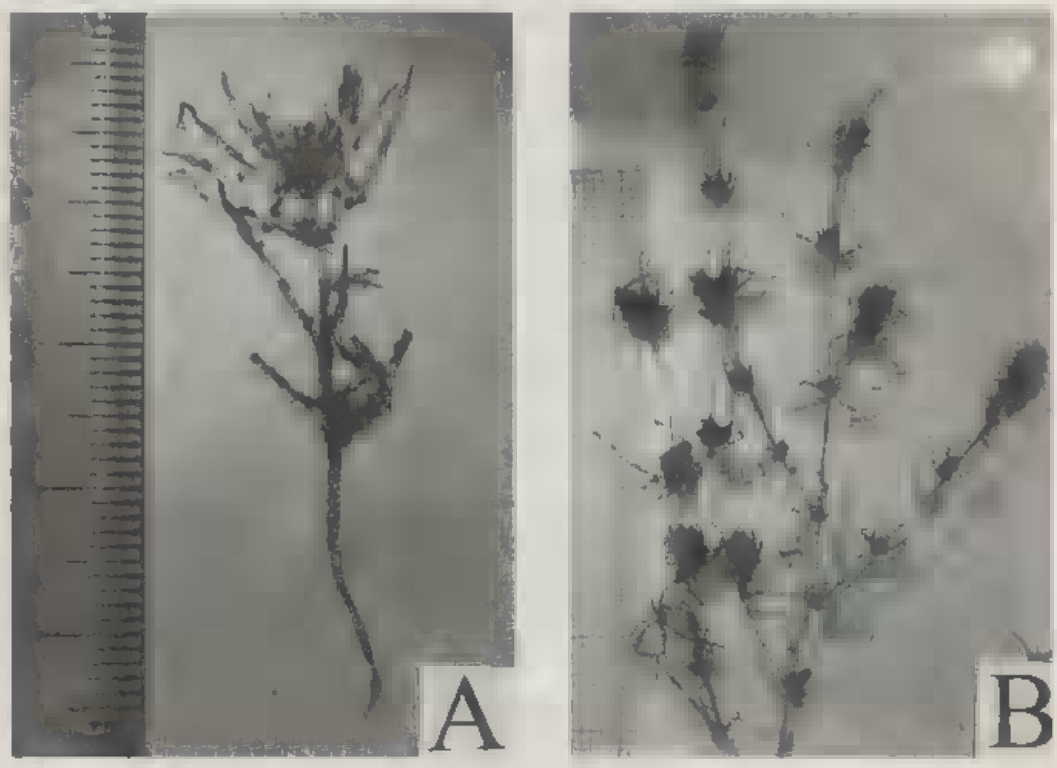

Figure 1. - *Chara baueri*. A. Specimen from Sweden. B. Specimen from Kazakhstan.

well developed. *Bracteoles* and *anterior* bract-cells c. as long as oogonium. *Posterior* bract-cells shorter. Rich fruiting, with some ripe oospores. Oogonium 600 µm long (unmature), 250 µm wide. Oospore 600 µm long, black. Antheridium 200 µm in diameter. The specimen was examined in dry condition.

Specimen studied; Sweden: Skåne, Brunnby, 28.7.1849 ex. herb Gyllenstierna (*In* Herb. W.Krause).

Description of the specimens from Kazakhstan (Fig. 1B and Fig. 2)

Plants monoecious, to 10 cm high. Not encrusted. Resemble *Chara braunii*. *Axes* to 570 µm in diameter, *internodes* to 1.5 cm long. *Stem cortex* 2-3 corticate, on young internodes most 2-corticate. On old internodes 3-corticate, often difficult to decide. Cortex- cells isostichous. *Spine-cells* solitary, to 380 µm long, acute, to 1x stem diameter, commonly shorter. Many spine-cells on young internodes. Old internodes with few spine-cells, often very short. *Stipulodes* in 1 tier, 1 per branchlet, up to 1.5 mm long. *Branchlets* 8-9 in a whorl, to 1 cm long, ecorticate, 0,1x to 1.5x internodes, with 4-5 segments. End-cell and 2-3 bract-cells form a *corona*. Corona 250-300 µm long. *Bract-cells* well developed. *Bracteoles* 2, as long as oogonium. Anterior and posterior bract-cells as long as the bracteoles or posterior bract-cells shorter. Rich fruiting. *Gametangia* conjoined at 1-2 lowest branchlet nodes. *Oogonia* 1mm long,

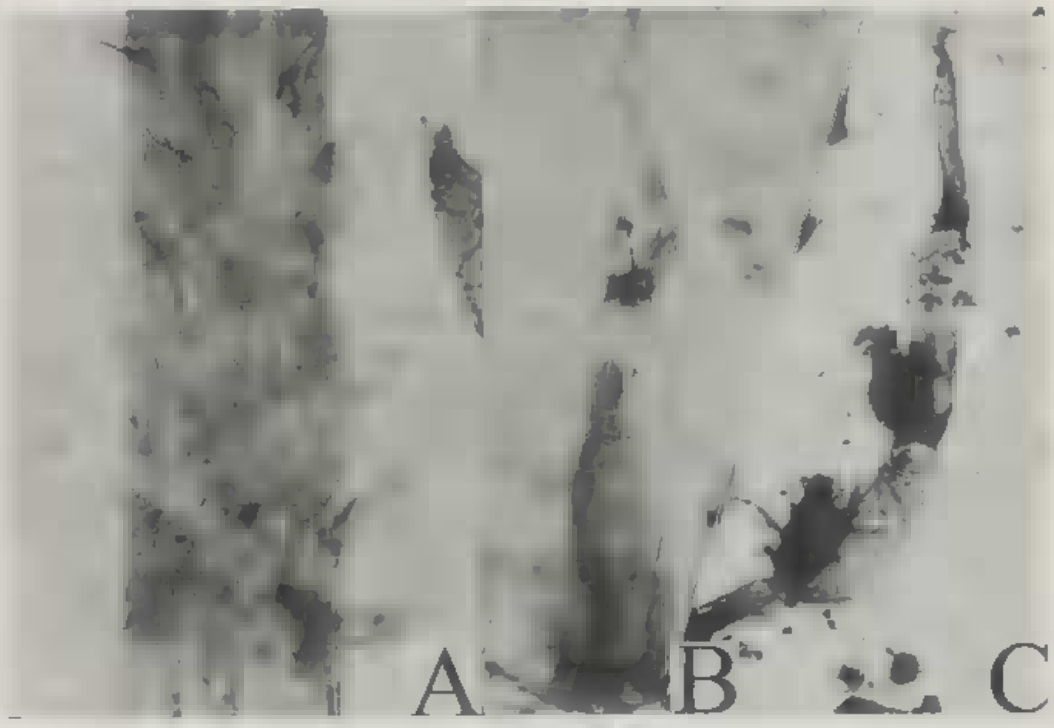

Figure 2. - *Chara baueri*. Details of specimens from Kazakhstan. A. Stem cortex 2-3 corticate. Spine-cells single, acute. Stem diameter 650 µm. B. Segment with corona. Length of corona 300 µm. C. Branchlet with oogonia. Length of one oogonium is 1000 µm.

450 µm wide, convolutions 10. *Coronula* 250 µm long and 250 µm wide. Oospore 500 µm long, 300 µm wide, black, with 8 ridges, *fossa* c. 45-50 µm. Antheridia small, 300 µm in diameter.

Specimens studied; Kazakhstan: Petropavlowsk. Coll. B.Sviridenko, 2.10.1994. (*In* Herb. O).

ECOLOGY

Little is known about the ecology of *Chara baueri.*

In Holtz (1903) one can read "Als Fundorte sind kleine Tümpel (bei Berlin, nach Bauer, mit Thonboden) bekannt. Sie wurde mit *Nitella batrachosperma, Ch. fragilis, Potamogeton trichoides* und *Elatine alsinastrum* gesellig gefunden."

Wood (1972) has produced reports about it based on finds in many different habitats "river, pond, pool, dam, water holes, marsh; on mud bottom; apparently only in fresh water."

Werner Krause says that its typical localities is muddy puddles or "hog pools". Such places seems to be improper for modern man, who empty or fill them up (Krause pers. comm.).

Description of locality in Kazakhstan.

Chara baueri was found in a shallow temporary pool situated 10 km east of Petropavlowsk in Kazakhstan (Fig. 3). The depth where the charophytes grew was 0.1 - 0.3 m, and the bottom was sand covered with a thin layer of silt. The growth of plants in the locality was rich and the two charophytes *Chara baueri* and *Nitella confervacea* A.Br. (= *N. batrachosperma* (Reich.) A.Br.) were found together with, *Lemna trisulca* L., *Limosella aquatica* L., *Callitriche verna* L., *Elatine alsinastrum* L., *Potamogeton gramineus* L., *P. obtusifolius* Mert. et Koch, *P. pusillus* L., *Alisma plantago-aquatica* L. and *Leptodictyum riparium* (Hedw.) Warnst.

The water was limerich and alkaline. The chemical parameters measured are:

Ca mg l^{-1}	*Mg mg l^{-1}*	*K and Na mg l^{-1}*	*HCO_3 mg l^{-1}l*	*Cl mg l^{-1}*	*SO_4 mg l^{-1}*	*Total salt g l^{-1}*
33,67	*11,19*	*26,25*	*195,26*	*7,80*	*11,01*	*0,28*

Chara baueri was heavily infected with the endophytic green alga *Coleochaete nitellarum* Jost. This is also known from *Chara braunii* in Norway.

Known distribution of *Chara baueri*

Chara baueri is well known from Europe where it earlier was found around Berlin, (Sydow, 1882; Migula, 1897; Holtz, 1903). It is also known in Austria, (Ganterer, 1847), Italy near Oldenico in Piemonte (Wood & Imahori, 1965) and Lituania (Hollerbach & Krassavina, 1983).

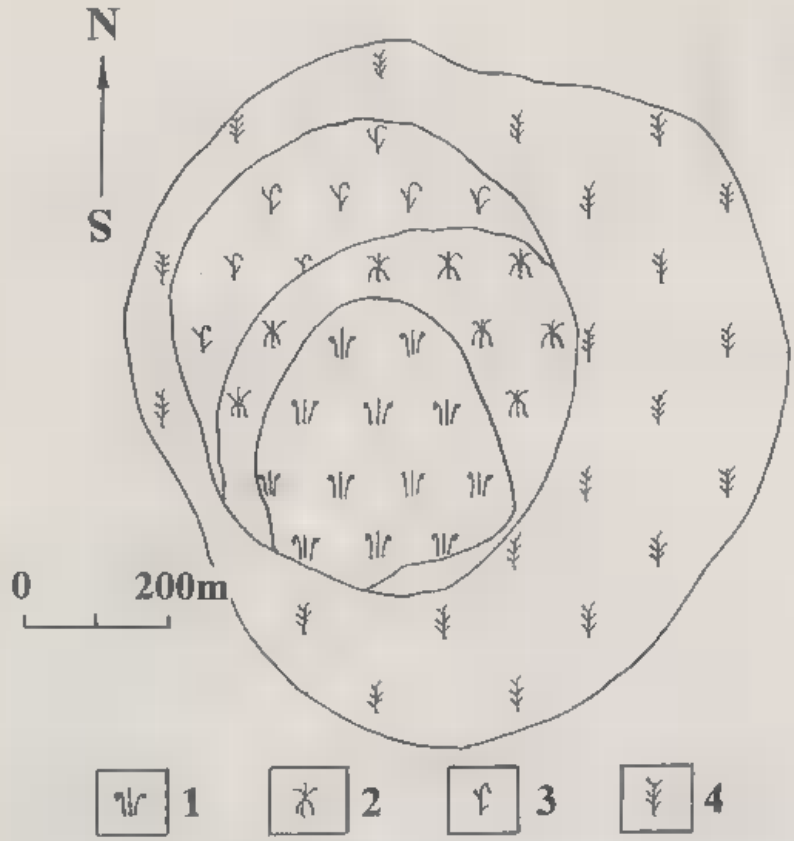

Figure 3. - Scheme of the temporary pool with distribution of plants. 1. *Typha angustifolia* L., *Utricularia vulgaris* L. and *Lemna trisulca* L. - 2. *Carex omskiana* Meinsh., *Utricularia vulgaris* L. and *Lemna trisulca* L. - 3. *Scolochloa festucacea* (Willd.) Link, *Carex riparia* Curt., *Lemna trisulca* L. and *Ricciocarpus natans* (L.) Corda - 4. Procoenoses of charophytes.

The species has recently been reported from Sweden in Blindow (1994), and it is confirmed by us based on herbarium specimen held by Werner Krause (Germany). In this article we report a new find from Kazakhstan.

The Australian occurrence of the species is reported in Braun & Nordstedt (1882), Nordstedt (1891), Holtz (1906), Hasslow (1939), Wood & Imahori (1959) and Wood (1972).

The known localities where *C. baueri* is found can be seen in figure 4.

DISCUSSION

Chara baueri has presumably not been found in Europe since 1871 (Holtz, 1903); dates on the Italian and Lituanian finds are not known. According to Hasslow (1939) the species was collected in New South Wales, Australia in 1936.

Figure 4. - All known localities with *Chara baueri*.

The present conditions in Berlin describe presumably what in general has happened to *Chara baueri* in Europe. In today's Berlin the number of charophytes has been recorded as being five. This is a decrease from 23 earlier known species (Geissler, 1988). The decrease is due to the growth of the metropolis Berlin, and it includes *Chara baueri*. The localities where this species is found, muddy puddles etc., have been easy to remove or fill in. We presume that there is still a chance to find the species in one of the numerous pools produced by today's building activities etc. e.g. in Berlin.

The distribution of *Chara baueri* is disjunct (Fig. 4) as it is found in Europe and in Australia. The new find in Kazakhstan links these two areas together, although there still is a great gap from Kazakhstan to Australia. The species has not been reported from India (Pal *et al.*, 1962), Burma (Pal, 1931), Malaysia (Zaneveld, 1940) where the charophyte flora is well known.

We agree with Wood & Imahori (1965) who says: "they may be relict areas in a one-time extensive species range from Europe to Australia." This view is supported by the discovery of the species in Kazakhstan. The fact that *C. baueri* is not found in tropical Asia can be due to the special climate. In earlier periods it is suggested that the

climate through the whole region where *C. baueri* must have been, was more like the climate in the areas where it is distributed today.

We do believe that long distance dispersal by birds also can be a probable explanation for the occurence of *Chara baueri* in Kazakhstan. There are several possible candidates who migrate from Europe to the Kazaksthan area in the spring (Alerstam, 1990). We would also suggest that the species should be looked for in Northern China.

Distribution patterns similar to *Chara baueri* are also known from phanerogames (Sunding,1970), and these are most probably historical.

Acknowledgment - We are indebted to Dr. Werner Krause (Germany) from whom we have lend the specimen of *Chara baueri* from Sweden and given us information about the species and to Dr. Oskar Garstein (Norway) who has corrected the English text and Lektor Toril Sørensen (Norway) who has translated the French summary.

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Commission paritaire 15-9-1981 - N° 58611 - Dépôt légal 2e trimestre 1995 - Imprimerie F. Paillart
Sortie des presses le 30 mai 1995 - Imprimé en France
Éditeur : A.D.A.C. (Association des Amis des Cryptogames)
Président : D. Lamy ; Secrétaire : B. Dennetière
Trésorier : E. Bury ; Directeur de la publication : H. Causse